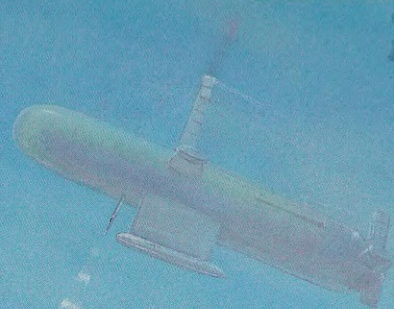


CAI
FS 210
- 1987
CIS



3 1761 11552196 5

Canadian
Publications



Canada's Oceans

An Economic Overview
and A Guide to Federal
Government Activities

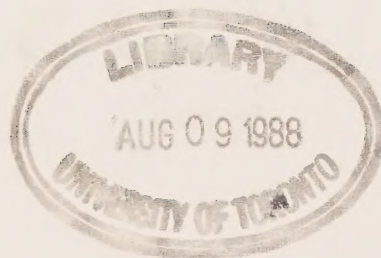


Fisheries
and Oceans

Pêches
et Océans

Canada's Oceans

An Economic Overview
and A Guide to Federal
Government Activities



Published by:

Information and Publications Branch
Communications Directorate
Department of Fisheries and Oceans
Ottawa, Ontario
K1A 0E6

DFO/3419

©Minister of Supply & Services
Canada 1987

Cat. No. Fs 23-115/1987E

ISBN 0-662-15644-7

"Egalement disponible en français
sous le titre : LES OCÉANS DU CANADA :
APERÇU ÉCONOMIQUE ET GUIDE DES ACTIVITÉS
DU GOUVERNEMENT FÉDÉRAL."

■ ■ ■ ■ ■ ■ ■ ■ ■ ■

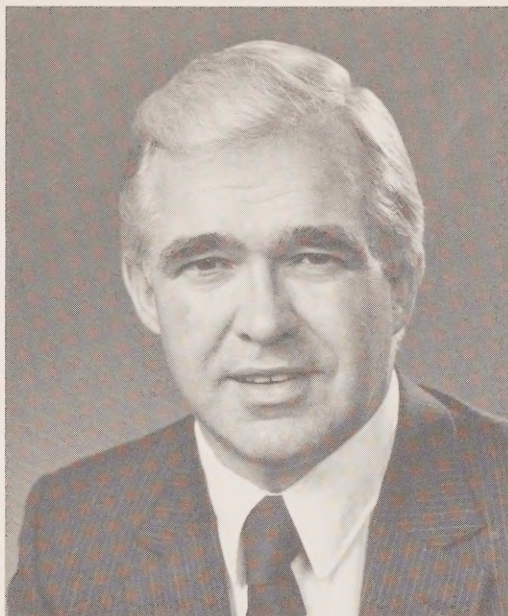
Table of Contents

PREFACE	3
EXECUTIVE SUMMARY	5
ECONOMIC OVERVIEW OF THE OCEANS SECTOR	11
Fisheries	13
Oil and Gas	15
Ocean Mining	16
Marine Shipping	18
Shipbuilding and Repair	18
Oceanic Manufacturing and Services	22
ROLE OF THE FEDERAL GOVERNMENT IN THE OCEANS SECTOR	27
A Broad Overview	29
FEDERAL OCEAN-RELATED ACTIVITIES	35
Marine Transportation	37
Other Marine Services	38
Resource Development and Management	39
a) Living Resources	39
b) Non-Living Resources	39
c) Environment Protection and Conservation	40
Sovereignty, Defence and Law of the Sea	40
Northern Development	42
Industrial Development	42
Marine Science and Technology Development	44
GOVERNMENT/INDUSTRY EXCHANGE	47
REFERENCES	53
Appendix	
Inventory of Federal Oceans-Related Programs and Activities	54



Digitized by the Internet Archive
in 2022 with funding from
University of Toronto

<https://archive.org/details/31761115521965>



Preface

A year ago at Oceans Forum in Patricia Bay, British Columbia, representatives of industries, universities, and government exchanged views on issues and opportunities related to our oceans frontier. That milestone conference signalled the need for a new national statement on oceans policy to carry us to the next century.

This report is an important next step in the government's development of a national policy to maximize the economic, scientific and sovereignty benefits of our three oceans, and to provide responsible stewardship in protecting our ocean heritage. It takes stock of the various industries of the oceanic sector and provides a comprehensive view of current federal programs and activities concerning our oceans. This report is also meant to inform Canadians of the economic opportunities that await the exploration and exploitation of our ocean resources.

I hope that this publication will stimulate interest in the oceans and awareness of their importance to Canada's economy, sovereignty and heritage.

A handwritten signature in dark ink, reading "Tom Siddon". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

*Tom Siddon, P.C., M.P.,
Minister of Fisheries and Oceans*

Executive Summary

Canada's oceans are an important element of the country's economy and will continue to be so in the future. This study provides a summary overview of Canada's oceanic economy and of current activities of federal government departments and agencies having responsibilities involving the oceans.

The Economic Importance of Canada's Oceans

More than \$8 billion and 140,000 jobs are directly attributable to the use of Canada's oceans and ocean resources.

Each of the major sectors of the oceans economy is discussed in this study, with emphasis on current economic conditions and future prospects for economic development.

Canada's oceanic industries compete in an environment where survival and success require world-class expertise. Canada now leads in many areas of ocean technology and there are several reasons why ocean science and technology are of strategic importance to Canada's national priorities:

(a) The sheer size of Canada's oceans jurisdiction entails major management responsibilities with respect to the use of the waters themselves and the resources in and below them. Knowledge, understanding and technology are the keys to successful management which in turn is perhaps the strongest expression of sovereignty.

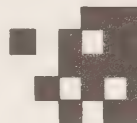
(b) If Canada is to determine its oceans development, it cannot be totally dependent on foreign suppliers for the necessary tools to accomplish it. Furthermore, there are clear advantages that arise from being the first to develop and make use of new technology.

(c) Resource-based industries such as fishing and petroleum, as well as other ocean industries such as shipping, shipbuilding and aquaculture, need continued access to leading-edge technologies if they are to remain competitive.


(d) There are numerous areas where Canada already has developed, or has the potential to develop, world-class technological capabilities. These should be demonstrated and tested in the world arena. This is particularly important in terms of the opportunities created as developing countries begin to take on the responsibilities of managing their ocean jurisdictions and developing their ocean resources.

(e) Significant growth potential exists for the industrial sectors which supply the technology needed for worldwide oceans development, provided appropriate emphasis is achieved by government, industry and universities on technological applications.

(f) The technology impetus generated by the offshore petroleum activities of the last decade has been temporarily reduced by the shift in the oil supply/demand balance. It is important to ensure that this crucial technology will still be in place when oil and gas activity resumes. Diversified applications of oil- and gas- related technologies will be necessary to sustain continued R&D in this area.



Federal Oceans Activities



The federal government has broad responsibility for the stewardship of Canada's oceans territory and resources. Federal expenditures on oceans-related activities amount to approximately \$1.3 billion annually and have a human-resource requirement of more than 13,000 person-years (excluding \$1.7 billion in annual expenditures and 17,800 person-years dedicated to the Maritime Command operations of the Department of National Defence). These activities are undertaken by the approximately 75 programs operated by 14 federal departments and agencies.

Federal oceans activities can be categorized according to seven broad functions. These categories are:

- (1) marine transportation;
- (2) other marine services;
- (3) resource development and management;
- (4) sovereignty, defence and law of the sea;
- (5) northern development;
- (6) industrial development; and
- (7) marine science and technology development.

While many oceans-related programs have more than one objective, they have been categorized in this inventory according to their *primary* objectives. For this reason, certain areas may appear under-represented in the inventory section of this study.

In addition to specific oceans-related programs, the Government of Canada has a range of broad policies in place which serve as mechanisms to promote the development of the oceans economy as a national priority.

Economic Overview of the Oceans Sector

More than \$8 billion of Canada's national income and more than 140,000 jobs come directly from the oceans. Figure 1 shows the relative outputs of the various components of the oceans sector. Table 1 presents estimates of current gross output (expenditures) and employment for selected oceans-sector activities.

**Figure 1: Oceans Sector Industries
(Estimated Output For 1985)**

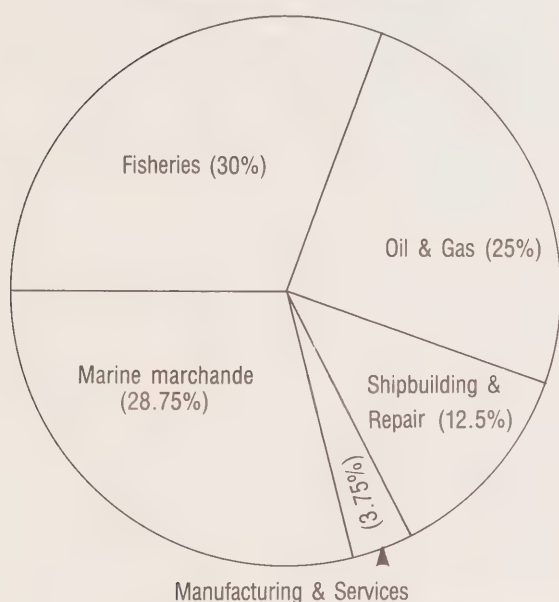


Table 1: Estimated Output and Employment for Selected Ocean Sector Industries in 1985 (1985 Canadian dollars)

Industry	Output or Expenditures (\$ billions) 1985	Employment ^a ('000) 1985
Primary Industries		
Fisheries ^b	2.4	100
Oil and gas	2.0	9
Marine Shipping ^c	2.3	17
Support Industries		
Shipbuilding and Repair	1.0	11
Oceanic Manufacturing and Services	0.3	6

^a Full-time and seasonal jobs (e.g. fisheries) are shown – not necessarily an estimate of person-years.

^b Preliminary estimate including production from commercial sea fisheries and aquaculture (excluding saltwater recreational fisheries with attributable expenditures of \$402 million).

^c Marine Shipping data is for 1984.

Fisheries

The value of Canadian *commercial sea fisheries* production in 1985 was \$2.4 billion of which \$1.9 billion was exported. In terms of value, Canada is the leading exporter of fish products in the world. Total employment in the sea fisheries in 1984 was 76,000 fishermen and 24,000 plant workers, many of whom were seasonal workers.

Canada enforces its 200-mile fisheries jurisdiction with diligence. The Department of Fisheries and Oceans patrols fishing areas both within Canada's jurisdiction and in certain waters managed by the Northwest Atlantic Fisheries Organization (NAFO). In 1986, 21 foreign vessels were arrested and close to a million dollars in fines were assessed in Atlantic Canada for various charges, including unauthorized entry and unauthorized fishing in Canadian fishing zones.

In Atlantic Canada, there are thousands of small-scale seasonal fishermen working from relatively small craft generally within 12 miles of the mainland and accounting for about 65 per cent of total landings and 78 per cent of landed value in 1985. There are also vertically integrated fish companies which operate year-round trawler fleets targeted primarily on groundfish out to the 200-mile limit.

Commercial fisheries account for only 0.5 per cent of Canada's GNP; in the provincial economies of Atlantic Canada, however, they play a far greater role. More than one quarter of Atlantic Canadians live in about 1,300 small fishing communities, half of which are single-sector fishing communities. In 1984, there were more than 700 fish plants employing almost 21,000 workers, and more than 30,000 vessels employing some 59,000 full- and part-time fishermen.

Fish resources of the Pacific coast are exploited by commercial, recreational and Indian food fisheries. The most important species is salmon. The commercial salmon fleet had 4,500 vessels in 1984, accounting for about 92 per cent of the total salmon catch.

In British Columbia, the commercial fisheries are the basis for much economic activity in 94 small fishing communities outside the industrial triangle of Vancouver, Victoria and Nanaimo. Many of these are single-sector communities. The commercial fishery employs 17,000 full- and part-time fishermen. The processing sector has about 144 plants and 3,000 employees.

A major problem facing the Atlantic fishery is surplus capacity which resulted from over-investment following the 1977 extension of the fishing zone to 200 miles. High debt exposure at a time of increasing interest rates and intense competition pushed the industry to the brink of financial collapse. A major restructuring and refinancing plan was negotiated in 1983 among the failing companies, their creditors and the federal and provincial governments. Three major companies were formed: Fishery Products International based in Newfoundland; National Sea Product Ltd. based in Nova Scotia; and Pêcheries Cartier Inc. based in Québec. The three companies account for almost 45 per cent of total Atlantic fish production.

The economic health of the inshore sector varies across the Atlantic region. In some areas such as northeast Newfoundland, the industry traditionally has been unable to provide adequate incomes to participants. In others, such as southwest Nova Scotia, many fishermen are able to derive good incomes from the inshore fishery.

In the Pacific fishery, catches have been good and the industry had recovered from the over-investment of the early 1980s, when debt exposure, coupled with over-capacity and declining stocks, resulted in substantial losses for the fishing fleet and bankruptcy for many small and medium-sized processors. A successful stock-recovery program, along with sound management and conservation practices, are crucial if the industry is to remain profitable.

The Salmonid Enhancement Program is an important element in the management of the west-coast salmon fisheries. This Department of Fisheries and Oceans (DFO) program uses a variety of scientific techniques, ranging from

simple to extremely complex, to enhance the natural production of salmonids. It makes a critical contribution to preserving fish habitat and generating employment in fish production, harvesting and processing.

Commercial *aquaculture* in Canada contributed approximately 6,000 tonnes of fish in 1985 worth approximately \$15 million, representing about 0.6 per cent of the total value of commercial fisheries production. There are currently some 1,000 licensed, commercial aquaculture operations in Canada. Significant growth is occurring in salmon farming on both the Atlantic and Pacific coasts, and in the culture of mussels and oysters. Since rapid growth in aquaculture has been typical in some areas of the world (e.g. Norway) and since Canada has good potential in terms of resources, aquaculture growth in Canada is expected to be considerable over the next decade.

The value of *recreational fisheries* is more difficult to estimate than that of commercial fisheries since market values for the recreational fisheries do not exist. On the Pacific coast alone, expenditures on support industries attributable to saltwater recreational fishing (e.g. equipment, boats, bait, accommodation, etc.) were approximately \$402 million in 1985. The 1985 Survey of Sportfishing in Canada found that 38 per cent of direct expenditures were on food and lodging, 53 per cent on transportation, and 9 per cent on fishing services and gear. Recreational activities, including recreational fishing, are expected to increase in the future with projected steady increases in leisure time, general increases in wealth, and a substantial increase in the population over 60 years of age.

There is potential for fisheries resource growth on both of Canada's coasts, particularly for the SEP-related growth of salmon fisheries in the Pacific. Canada may also have opportunities to expand fish exports significantly over the next decade especially for value-added products. The key areas of ocean science that could contribute to the future development and growth of the fishing industry include:

- improvements in vessels and gear technology;
- enhancement of fishing surveillance capability;
- an ocean mapping program; and
- improved knowledge of the distribution and abundance of fish, marine mammals, and marine invertebrates, particularly in boundary dispute areas, at the edge of the 200-mile fishing zone, and in the Arctic.

Oil and Gas Exploration and Development

Canada's offshore areas contain substantial reserves of oil and gas. The east-coast offshore region alone holds 30 per cent of Canada's oil potential and 17 per cent of the gas potential. Of the 128 significant discoveries on the entire frontier lands to date, 78 have been found in offshore areas. In each of the major frontier areas, at least one large pool of oil or gas has been discovered and delineated. In the east-coast offshore, development plans and approvals have been submitted for the Venture gas development project (Scotian Shelf) and the Hibernia oil project (Grand Banks).

Development projects in the Canadian offshore are being planned at this time. In the North, seasonal production at the Amauligak location in the Beaufort Sea is being planned for 1989. On the east coast, development will likely start with the Terra Nova and Hibernia fields in the early 1990s. The Venture gas development project, involving production from three gas discoveries near Sable Island, will likely come onstream in the mid-1990s. Each of these will undoubtedly require higher oil prices.

The oil and gas industry has invested heavily in exploration and development work in the offshore areas of the frontier lands. Over the five years from 1981 to 1985, expenditures for offshore drilling totalled more than \$7 billion. Exploration and development expenditures for 1985 are summarized in Table 2.

The recent decline in drilling activity has been caused by low international oil prices and the fact that the drilling requirements of most of the original exploration agreements were fulfilled between 1982 and 1985, resulting in a very high level of activity during that period.

Operators are now interpreting the results of this drilling before embarking on the subsequent phase of exploration under the second-round exploration agreements. Exploration activity tends to be cyclical in nature. For example, two complete cycles of activity have occurred in the east-coast exploration areas.

Canadian offshore exploration faces unique challenges such as great distances from supply bases and exposure to open ocean weather, drifting pack ice, icebergs and multiple-year ice in the Arctic Ocean. To meet these challenges, new technologies, improved scientific information about the environment, and specialized scientific services will be required.

Ocean Mining

Historically, the private sector has not shown a widespread interest in exploring and developing offshore mineral deposits. This has been due to several factors:

- the potential has not been fully investigated;
- market prices and conditions have not been favourable;
- relevant geological and technical information has been unavailable;

Table 2: Total 1985 Petroleum Expenditures on the Oceans Frontier^a

	Exploration (\$M)	Development (\$M)	Total (\$M)
Mackenzie Delta and Beaufort Sea	798.9	0	798.9
Arctic Islands and Eastern Arctic Offshore	48.2	7.8	56.0
Hudson Bay	37.4	0	37.4
Grand Banks and Labrador Sea	657.3	0	657.3
Nova Scotia Offshore	481.2	0	481.2
TOTAL	2,023.0	7.8	2,030.8

^a Excludes mainland territories (Yukon and NWT) where \$129.3 million in exploration and \$58.7 million in development took place.
Source: The Canada Oil and Gas Lands Administration Annual Report 1985.

- mining regulations appropriate for the offshore do not exist; and
- uncertainties exist concerning federal and provincial jurisdictions and the 1982 Convention on the Law of the Sea jurisdiction on ocean mining.

More than 20 million cubic metres of sand and gravel have been mined from the Canadian Beaufort Sea since 1972 to construct artificial islands in support of oil and gas development, making it the largest dredging project in the Canadian offshore. There is a licensed mining operation for nearshore sand and gravel in the Prince Rupert area. Small amounts of sand and gravel have been dredged from nearshore waters off Newfoundland. There have also been exploration activities to delineate gold deposits off Nova Scotia and silica sand deposits off the Magdalen Islands.

Gold, silica sand, and sand and gravel deposits in Canada's oceans have the greatest likelihood of being developed within the foreseeable future. Although there are other minerals which could be mined, there is no evidence that their production would have a significant value.

Neither the by-product recovery and sales nor the mineral resources in the Arctic are considered in the following estimates although some potential may exist for gold-bearing sands. The technology for Arctic offshore mining exists as demonstrated by sand and gravel dredging. In addition, tin placers are mined offshore in the Soviet Arctic.

Department of Energy, Mines and Resources forecasts, based on current consumption and production statistics, size and distribution of offshore deposits, and markets in each coastal province, indicate that production by the end of the century could range from \$25 million to \$400

million. East-coast production will likely be more significant than west-coast production. Sand and gravel estimates are based on domestic market requirements. Since sand and gravel are known to occur widely and the area of seafloor for the required yields is small, it is assumed that sufficient supplies exist on both coasts. The production of silica sand is also based on domestic market requirements and resources in known deposits. The development potential seems excellent for the east-coast but limited on the west-coast. In both Nova Scotia and British Columbia, the likelihood of offshore gold production is high, although uncertainties exist concerning the nature, extent and grade of deposits and the price of gold in the future. There are also indications that gold production could take place in the Bay of Fundy off the New Brunswick coast, east of Saint John.

Another area with potential is the seabed beyond the limits of national jurisdiction. Over the past 15 years, multinational consortia in which Canadian companies have interests have been among the entities investing in exploration in this area. For the foreseeable future, however, economic and legal uncertainties will hinder more rapid development. Canada is actively involved in efforts to resolve outstanding legal issues. Canada participates in the work of the Preparatory Commission for the United Nations Convention on the Law of the Sea in order to promote the development of a deep seabed mining regime that encourages universal acceptance of the Convention. When the Preparatory Commission completes its complex task, Canada will be in a position to determine whether to ratify the Convention.

Development of non-fuel minerals offshore may one day offer commercial opportunities for the Canadian private sector. However, the economic potential of non-fuel minerals offshore, with the possible exception of aggregates such as sand and gravel, is quite modest given current prices and market conditions.

Marine Shipping

In 1984, there were 320 Canadian marine carriers owning and operating 1,957 vessels and employing 16,519 crew members. They generated a gross revenue of \$2.3 billion. A breakdown of these total figures is presented in Table 3.

Table 4 provides a regional distribution of revenues. These data refer only to ships which fly Canadian flags and, since most multinationally operated, Canadian-owned freighters do not fly a Canadian flag, the data underestimate the revenues from water transport. About 28 per cent is inland, 29 per cent is from international trade, 16 per cent is from the Pacific, and the remainder is split among Atlantic and northern regions. The west-coast is characterized by tug and barge operations while the east-coast is characterized mainly by small coastal freighters.

Canada has concentrated on development of its seaway fleet because of its importance to the domestic economy and the need for efficient, economical transportation of the country's resource materials, leaving the deep-sea business to operate under international competitive market conditions. More recently, however, lake vessels have been built with ocean-going capabilities. As the aging domestic fleet is gradually replaced, Canada may have some potential in the long term to increase its share of international shipping. Expenditures and employment are expected to drop during the next decade, largely because of declines in shipbuilding activities.

Shipbuilding and Repair Industry

The Canadian shipbuilding industry is composed of 18 large shipyards with approximately 300 workers each and about 50 smaller yards and repair shops. The large yards represent 90 per cent of employment and 92 per cent of total Canadian shipbuilding and repairs. The governments of Newfoundland, Nova Scotia, P.E.I., and Quebec own or have an interest in a number of Canadian shipyards. Table 5 summarizes expenditures and employment in 1985 for Canadian Shipbuilding and Ship Repairing Association

Table 3: 1984 Marine Shipping

Type of Carrier	No. of Establishments	Gross Revenue (\$ million)	No. of Vessels	Crew	Wages (\$ million)
For-hire Carriers	214	1,245	1,115	6,555	253.1
Private Carriers	48	567	244	1,675	66.4
Government Carriers	30	436	540	7,879	220.8
Sightseeing	28	17	58	428	4.0
Total:	320	2,265	1,957	16,519	544.2

Source: Statistics Canada, Catalogue 54-205

Table 4: All Carrier Revenue from Water Transportation, by Area of Operation, by Type of Operation, 1984

Area of Operation	Number of Carriers Domicile Operation ¹	Transport of Commodities	Transport of Passenger	Chartering to Others	Towing	Other Vessel Revenues	Subsidies	Total ²	% of Total
Domestic									
Atlantic	38	99,967,475	13,022,369	98,692,603	7,119,874	107,657	—	218,909,978	9.6
Pacific	87	96,146,529	43,035,997	6,034,102	203,939,419	11,293,384	—	360,449,431	15.9
Inland ³	108	519,726,551	20,836,375	55,437,654	34,523,422	4,039,578	—	634,563,580	28.0
Arctic and Mackenzie River ⁴	13	35,128,804	5,018,314	66,837,591	450,238	41,645	—	107,476,592	4.7
International									
No Area Assigned	49	—	—	41,095,160	—	—	247,272,035	288,367,195	12.7
TOTAL²	320	1,334,096,946	83,281,579	308,708,952	274,797,316	16,977,582	247,272,035	2,265,134,410	100.0

¹ The total number of operating units differs from the number of carriers which filed a water transportation report because frequently a carrier operates in more than one area (and is therefore counted in more than one area) or is not able to report an area for bareboat chartering to others.

² Some figures may not add up to totals due to rounding.

³ Includes Arctic and Mackenzie River area private carriers' data.

⁴ Includes international area government carriers' data.

Source: Adapted from Stats. Can. 1984, Cat. 54-205, Annual.



Table 5: Shipbuilding and Repair Expenditures and Employment in CSSRA Member Yards (1985)^a

Area	Expenditures (\$000)			Employment
	New Construction	Repairs and Conversions	Total	
West Coast	114,462	76,921	191,383	1,900
Great Lakes and St. Lawrence	207,677	99,106	306,783	3,850
East Coast	140,271	54,037	194,308	2,330
Total (CSSRA)	462,410	230,064	692,474	8,080
Total (Canada)			1,009,000^b	10,933^b

^a Source: Canadian Shipbuilding and Ship Repairing Association, 1985 Annual Statistical Report.

^b CSSRA estimate.

(CSSRA) member yards and for total Canadian shipbuilding and repairing. Both expenditures and employment are expected to drop during the next decade, largely because of declines in shipbuilding activities.

Total employment in the shipbuilding and repair industry increased from about 9,000 in 1984 to about 11,000 in 1985, a rise of 16 per cent. However, employment remains lower than the roughly 15,000 people employed annually over much of the past decade. Employment levels may decline over the next decade although proposed work on certain Department of National Defence (DND) projects, the Polar (Class 8) icebreaker, and Grand Banks and Scotian Shelf offshore development could maintain employment around 1985 levels. There are shipbuilding and repair facilities in every province but Saskatchewan, and employment in 1985 was distributed more or less equally in the western, Great Lakes, St. Lawrence, and eastern regions of Canada.

Exports have decreased due to declining international markets and the erosion of Canada's competitive position in foreign markets. Canadian shipyards exported more than \$300 million in 1982 but only \$25 million in 1985. Domestic repair work has increased slightly and is expected to continue to provide an element of stability.

Over the last 10 years, new construction has made up approximately of 60 to 70 per cent of the total value of marine work in CSSRA member yards. In 1983, 91 per cent of new construction was commercial while 9 per cent was government procurement. By contrast, in 1985 these shares were 35 per cent and 65 per cent respectively. These shares will continue to reflect a large government share during the rest of this decade.

Canada's international competitiveness has been handicapped by inefficiencies in ship construction, yard layout and materials handling, all of which limit the size and type of vessels that can be constructed or repaired. In addition, improved technology is required in steelwork production, outfit production and other activities

such as integrated steel-working facilities to produce ship block assemblies and heavy cranes facilities to transport these assemblies in the yard. Other factors which help to explain Canada's generally weak competitive position include overcapacity, limited vertical integration with supply firms, dependence on imported marine components, foreign dumping and offshore subsidies. Although Canadian shipyards have collective experience in the construction of a wide range of vessels and offshore oil and gas equipment, shipbuilding countries such as Korea, Japan, the United States, and western Europe offer highly competitive facilities and wage rates.

World demand for shipbuilding declined between 1974 and 1978, particularly for new merchant ships, offshore equipment, and LNG and oil tankers. Since 1978, the economic recession and persistently high levels of industry overcapacity have contributed to an uneven and tentative recovery. The short-term forecast is poor.

In response to difficult times, many of the world's shipbuilding nations, particularly European nations and Japan, have implemented rationalization policies. Since 1975, the capacity of European yards has fallen by approximately 48 per cent and that of Japanese yards by 35 per cent. However, much this capacity could be put back into production should demand pick up.

Overall capacity is forecast to remain stable in the medium term although the geographical distribution of that capacity could change significantly. Shipbuilding industries in Korea and China are growing largely at the expense of European yards. In the future, this growth is expected to affect Japan as well.

Korea's position in the world shipbuilding market has risen from twenty-third in 1973 to second in 1983. This rise has been due to technology spin-offs from Japan, cheap and abundant labour, and the ability to produce a wide variety of ship types.

Canada is a marginal supplier and a price-taker in world shipbuilding. With continued decline in markets expected until 1989, when modest increases in demand are forecasted, the Canadian industry's major concern is to preserve the domestic market against increasing pressure from foreign countries.

Although tanker and bulk-carrier markets are in a position of over supply, world demand is expected to revive by 1990 except for LNG tankers. It is anticipated that roll-on roll-off vessels, container vessels, and small general cargo vessels which are more versatile, will gain at the expense of large general cargo vessels. Offshore-service vessels are poor short-term prospects for the shipbuilding industry, but demand should increase in the medium- to long-term particularly for larger, more powerful vessels with sophisticated designs.

Within the offshore exploration equipment sector, demand for semi-submersibles is expected to recover before demand for drillships and jack-ups. Semi-submersibles are expected to capture part of the drillship market. The most likely sources of growth for offshore production equipment are floating production systems, particularly ship-shaped systems, and sub-sea facilities. However, demand for offshore equipment depends on oil prices and the timing of development projects such as Hibernia and Venture.



Domestically, government procurement (primarily by DND, the Coast Guard, DFO and Public Works) is expected to constitute about 49 per cent of total new conventional construction, mainly due to the large volume of government work projected during the 1985-88 period. These orders will temporarily obscure the effects of weak commercial demand. In addition, the Government of Canada has announced the construction of a Polar (Class 8) icebreaker. Further, the government has announced its intention to place orders for submarines capable of patrolling the Arctic waters as well as the country's other oceans.

Oceanic Manufacturing and Services

Canada is one of the only half-dozen nations of the world with internationally competitive stature, technologies and capabilities in the multi-disciplinary fields of oceanography and hydrography. During the past 10 years, the oceanic private sector has acquired the field experience and has become sufficiently innovative with its own technologies and with the technologies of others to compete in markets abroad against the traditional leaders — the United States, the United Kingdom, France, The Netherlands and now Norway and Japan.

The Canadian oceanic manufacturing and services industry has developed in response to the commercial opportunities created by the establishment of national institutes in marine, fisheries, environmental and resource sciences and engineering; government contract and R&D spending; maritime defence requirements; and, in particular, offshore oil and gas exploration activities of the past two decades.

The manufacturers have products, systems and software for oceanographic, hydrographic, diving and other operational marine applications, for marine-related remote sensing, submersibles and seabed systems. The services sub-sector covers a large range of activity based in engineering, sciences, consulting and surveying, including aerial surveying, with marine applications. All companies employ advanced technologies. Many of them also develop or adapt advanced technologies, systems and software for innovative applications.

There are currently about 500 companies forming the oceanic services and manufacturing sector in Canada. Governments are the most important customers, with the federal government, through several departments, institutes, agencies and special-purpose funds, the single biggest purchaser. In addition to direct purchases of goods and services for specific programs, federal funding of private-sector R&D is a significant factor in the financial health of participating firms and is the source of a wide variety of innovations in oceans-related products, systems, software, services and techniques. These are applied in Canada and, in many cases, result in successful export activities. The domestic offshore exploration industry is currently the second largest overall customer for Canadian oceanic industry products and services. Its decline in the early 1980's has led to a sharp decline in private sector demand in the oceanic manufacturing and services sector.

There is an evident entrepreneurial character in oceanic manufacturing and services. Canadian products and skills have been, and are being, sold in more than 80 countries. The largest future market opportunities lie in the Exclusive Economic Zones of developing coastal states.

The health and growth of Canadian oceanic manufacturing and services are tied largely to international conditions that are beyond its control and the control of Canada, and these are both troubled and challenging times for many of Canada's small ocean manufacturing and services industry, an industry where international competitiveness is often a key to survival. However, federal expenditures on a continuing basis provide a floor activity to support and maintain basic levels of employment on a year-to-year basis. Domestic fortunes fluctuate with the varying pace of exploration and delineation drilling offshore.

Sales estimates for the industry for 1984 and 1986 are provided in Table 6.

The approximately 200 companies in the manufacturing sub-sector are concentrated in British Columbia, Alberta, Ontario, Québec, Nova Scotia and Newfoundland. Few of these companies are dependent exclusively on offshore oil and gas field exploration, development and/or production. Their technologies, products and related service/maintenance/repair activities are also sold to a variety of ocean users in marine sciences, fisheries, marine transportation, environmental management and control, northern development, defence, aerospace and remote sensing, offshore supply, etc.


The majority of Canadian manufacturing firms are small, employing five to 50 people, and are privately owned by entrepreneurs or employees, rather than publicly owned through Canadian stock exchange listings. Most have sales in the range of \$500,000 to \$10 million a year.

The manufacturing sector's 1985 total sales of all products including oceanic/marine have been estimated by the Department of Regional Industrial Expansion (DRIE) to be in the range of \$150 million to \$200 million. Total employment was approximately 2,500, although this may be an under-estimate.

Export markets throughout the world are extremely significant to this group, although there are wide disparities in levels of involvement. DRIE has estimated that exports may represent up to 70 per cent of the annual total manufacturing sales of some firms. Principal markets are in the North Sea (U.K. and Norwegian sectors), south-east Asia, the Arabian Gulf, South America and the United States. The Canadian International Development Agency (CIDA) is an important conduit for sales to developing countries.

Table 6: Oceanic Manufacturing and Services – Sales Estimates

Firms	No. of Firms	1984	1986
		(\$ Millions)	
Oceanic Manufacturing (including 75 electronics)	200	200	150
Oceanic Services and Consultants (including engineering & surveying)	250	140	100
Diving	50	30	12
Estimated Total	500	370	262



The services sub-sector includes some 250 consultants: oceanographic, hydrographic, cartographic, geophysical, engineering; marine environmental; diving firms and ice specialists, concentrated in British Columbia, Alberta, Ontario, Québec, Nova Scotia and Newfoundland. Also, a segment of the aerial surveying industry provides a range of services.

This sub-sector participates widely at all stages of ocean exploitation, beginning with the pre-exploration phase of scientific and environmental studies and analysis to supplement government in-house capabilities and activities, then expanding and changing focus throughout the extended period of exploration. The offshore field development phase, which takes about five years, requires a high degree of services involvement and the addition of a wider range of companies. Once production begins at an individual field, types of service activities change in character, focussing on inspection, maintenance and repairs to offshore structures and sub-sea installations. At the same time, overall employment that is offshore production-related is reduced as jobs become operational in character.

Canadian private-sector hydrographic, oceanographic and geophysical surveying in 1985 was estimated at \$50 million but is expected to have dropped to \$40 million or lower in 1986. On the other hand, the current level of export activity is estimated at approximately \$10 million, with a potential of \$50 million to \$75 million or more.

Some 100 firms of all sizes have their primary business activity in one or more of the above three surveying fields. Another 75 or more firms include some of these services as part of engineering consulting and services or in conjunction with conventional aerial surveying and remote sensing with marine applications. Some environmental consultants and firms in the fresh water field offer oceans-related services. A few very large firms offer a spectrum of such services at home and abroad. There are some 50 diving services firms, offering a variety of general and specialized skills. Perhaps 25 of them are export-capable.

Annual total exports by services firms, including their non-oceanic activities, are currently estimated to exceed \$50 million. Employment has fluctuated with the domestic and foreign economies and was estimated in 1986 to be approximately 3,500. Cutbacks in exploration activities since 1985, both Canadian and worldwide, will hurt the services sub-sector, particularly small, specialized firms which cannot diversify into other areas.

Role of the Federal Government in the Oceans Sector

The previous section of this study provides an overview of economic conditions in the various industrial components of the oceans sector. Before discussing federal-government activities in detail, this section describes the overall role of federal departments in oceans development and, in particular, the role of particular departments.

A Broad Overview

The federal government has broad responsibility for the stewardship of Canada's oceans jurisdiction. That responsibility encompasses activities on, in and below the water, and extends to resources and resource users. The role of the government in oceans can be summarized as follows:

- understanding the offshore environment and its resources;
- encouraging economic development;
- mediating conflicts between user groups;
- protecting the common resource base and the marine environment;
- providing infrastructure for safe navigation; and
- preserving and enhancing Canadian sovereignty.

The federal role is carried out through an assortment of policies. Neither the policies nor the programs for implementing them are centralized within a single department or agency. Instead, some 14 primary departments and agencies administer approximately 75 programs which have a direct bearing on oceans.

The role of coordinating the policies and programs of the federal government respecting oceans has been assigned by legislation to the *Minister of Fisheries and Oceans*. The duties, powers and functions of the Minister of Fisheries and Oceans, as defined in the *Government Organization Act* include:

(a) all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department, board or agency of the Government of Canada, relating to:

- i) sea coast and inland fisheries,
- ii) fishing and recreational harbours,
- iii) hydrographic and marine sciences,
- and

iv) the coordination of the policies and programs of the Government of Canada respecting oceans.

(b) such other matters over which the Parliament of Canada has jurisdiction relating to oceans as are by law assigned to the Minister.

The *Interdepartmental Committee on Oceans* (ICO), chaired by the Deputy Minister of Fisheries and Oceans, coordinates federal activities respecting marine science and oceanic programs. ICO has representation from all departments and agencies with oceanic programs, as well as those departments requiring services from such programs. The mandate for the ICO is:

- to review and facilitate the marine science operations in programs of the federal government, with particular attention to the sustainable economic development and stewardship of Canada's offshore jurisdiction;

- to develop a multi-year marine science plan for the federal government, bringing together in one comprehensive plan the marine science plans of the departments, and to update this plan annually;

- to prepare reports for the Minister of Fisheries and Oceans to present to Cabinet on the accomplishments of the government's marine science efforts;

- to ensure effective coordination of the federal government's marine science activities and to provide a forum for the discussion of marine science issues; and

- to coordinate federal efforts to foster the growth of an ocean industry in Canada, and to encourage the development and widespread private-sector use of marine data and forecasts.

This mandate is intended to raise the profile of the government's marine science effort and to ensure achievement of the government's objectives in six areas of significant importance:

- sovereignty or sovereign rights in the offshore;
- economic viability for the fishing industry, and conservation of living marine resources;
- offshore resource exploration and exploitation;
- the development of a viable ocean industry which is competitive in world markets;
- the protection of the aquatic environment; and
- climate and weather prediction.

In November 1986, First Ministers agreed that government attention be given to fostering the development of Canadian aquaculture. Fisheries Ministers subsequently decided that Federal-Provincial Aquaculture Agreements would provide the framework for this development. Negotiation of these agreements is actively underway.

The *Minister of State for Science and Technology* has been charged with the responsibility of developing a national policy on science and technology. Towards this goal, a decision framework and a new Canadian Strategy for Science and Technology have been developed. These strive to enhance the relevance and effectiveness of federal expenditures in relation to government priorities based on economic and regional development needs, government missions and the general advancement of knowledge. Government has a basic role to create a climate which encourages innovation and entrepreneurship, the creation of future-oriented jobs and an improved focus on international competitiveness.

With respect to offshore oil and gas, the *Department of Energy, Mines and Resources (EMR)*, DFO, and other federal departments have responded to requests for improved scientific information about the environment as well as specialized scientific services, through major changes in their research programs and improvements in their formal data services. EMR programs have provided geoscientific information to stimulate and facilitate exploration activities. DFO science programs have supplied special charts of production areas, information on sea and ice conditions, ocean chemistry, etc.

Canada's *Minister of State for Mines* is leading federal and provincial efforts to encourage the development of offshore non-fuel mineral resources by providing appropriate information and establishing clear ground rules. A number of cooperative efforts are being made in this regard:

- EMR has set up an Ocean Mining Citation Retrieval System for references on various aspects of offshore non-fuel mineral development. Reference lists related to offshore mineral development are now available to Canadian industry relating to geology, exploration technology, mining, economics, environmental impact, and legal aspects of offshore mineral development;

- In cooperation with a number of coastal provinces, EMR will compile an inventory of available resource-related geological information from near-shore areas where, for the foreseeable future, most exploration and development will take place;

- Following an EMR assessment of placer drilling and extraction technologies that can be used on the Canadian continental shelf, a follow-up project has been undertaken in cooperation with industry and the Nova Scotia Department of Mines and Resources;

- Efforts are under way to provide industry with a simple, stable set of groundrules for developing non-fuel minerals offshore that would accommodate the special conditions required for offshore operations. The use of uniform mining regulations for all offshore areas under both federal and provincial jurisdiction is being discussed and could be a key step to establishing the type of investment climate needed to foster development; and

- Environmental and fisheries protection would be encouraged as an essential element of early project planning at all stages of offshore development. In cooperation with interested provinces, efforts are being made to apply the experience of other countries when developing Canadian approaches.


The *Department of National Defence* stands out as the largest single departmental consumer of oceans sector goods and services. Canada's Maritime Forces place substantial demands on oceans science, technology and service industries, both for small-scale needs as well as major capital construction projects. The ocean-sector support of defence industries occurs primarily in the oceanic manufacturing and services industry and the shipbuilding and repair industries. Defence spending contributes in a major way to the development of these oceans industries.

- The Maritime Command Forces and Air Command aircraft under the operational control of Maritime Command operate from seven bases, five stations, and one detachment, located primarily on the east and west coasts.

- The Canadian Patrol Frigate Project, to be completed by 1992 at a cost of \$5.3 billion, will result in the construction of six warships to replace the oldest of the steam destroyers currently in use. To enhance the anti-submarine warfare capability of the Navy, towed array sonar equipment will be fitted to these new frigates at a total cost of \$112 million.

- The four DDH 280 or Tribal Class ships entered operational service in 1972 and 1973 and will reach their mid-life point in 1987-88.





- Future major maritime projects include the Canadian Submarine Acquisition Project and the New Shipborne Aircraft Project. The first is aimed at acquiring a minimum of four conventional (diesel-electric) submarines to replace three aging Oberon-class submarines which will reach the end of their service life in the period 1995-2000.

- The New Shipborne Aircraft Project is aimed at replacing the 35 aging Sea King helicopters in the Canadian Forces with between 28 and 51 new aircraft. The primary mission of these aircraft will be tasking for anti-submarine warfare and anti-surface surveillance and targeting with secondary capabilities for search and rescue, vertical replenishment (sling operations) and medical evacuation. Project completion is scheduled for 1996-97 and total program costs could be in excess of \$2 billion.

- The Chief of Research and Development, with a 1986-87 budget of approximately \$210 million, is responsible for R&D activities and scientific consultation aimed directly at enhancing the operational capabilities of the Canadian Forces. Knowledge of ocean sciences is indispensable for efficient maritime operations. A greater understanding of the environmental parameters of the ocean as well as those of the atmosphere and the earth is essential for effective use of anti-submarine warfare systems by surface ships, submarines and marine patrol aircraft.

Federal Oceans-Related Activities

To address its coordination responsibilities more effectively and in response to a request by the Prime Minister, the Department of Fisheries and Oceans recently assembled an inventory of federal ocean activities. This inventory provides detailed descriptions of activities along with expenditure and person-year data. The inventory is summarized in this section.

Federal expenditures under the programs reviewed in the inventory amount to approximately \$1.3 billion annually and have a human-resource requirement of more than 13,000 person-years (excluding \$1.7 billion in annual expenditures and 17,800 person-years dedicated to the Maritime Command operations of DND).

Federal oceans activities can be categorized according to seven broad functions. They are:

- (1) marine transportation;
- (2) other marine services;
- (3) resource development and management;
- (4) sovereignty, defence and law of the sea;
- (5) northern development;
- (6) industrial development; and
- (7) marine science and technology development.

A listing of the activities within these categories is presented in Appendix 1, along with responsible departments, the legal authorities, and the financial and human resources associated with each.

While many oceans-related programs may have more than one objective, they have been categorized according to their primary objectives. For this reason, certain areas, most notably sovereignty and northern development, may appear somewhat under-represented. For example, fisheries resource allocation, offshore geoscience, defence R&D, and hydrography all have important sovereignty implications even though these programs have been established to meet other objectives. Similarly, many federal scientific research programs have industrial development, marine transportation or resource management implications.

Marine Transportation

The purpose of federal involvement in marine transportation is to provide a reliable, safe system for marine navigation, and to ensure marine safety and environmental protection through the effective regulation of ships.

The primary responsibility for marine transportation rests with Transport Canada and, with respect to ship operations and safety specifically, the Canadian Coast Guard. Its marine-related activities are aimed at expeditious and safe navigation of Canadian waters. A significant portion of its marine budget is spent on marine navigation systems which include the following:

- short-range fixed and floating navigation aids such as lighthouses, range lights, buoys, etc., which mark channels, harbour entrances and obstructions;
- long-range electronic aids to help mariners determine the position of their vessels. These include Loran-C, Decca and radiobeacons;

- provision and maintenance of waterways in support of commercial vessel movement and the guarantee of unobstructed passage;

- provision of vessel traffic services aimed at safety for marine traffic, e.g., marine safety information by way of radio broadcasts, publications, and Notices to Mariners; and screening for defects or deficiencies in foreign vessels entering Canadian waters; and

- provision of ship-to-shore maritime mobile communication service for safety and public correspondence.

The Canadian Coast Guard is also responsible for marine regulations and ship inspections. This involves the development and enforcement of marine regulations aimed at safety and pollution prevention and takes the form of mandatory compliance checks. Some 4,700 ship safety inspections are carried out annually in Canada.

Icebreaking and other Arctic operations include: route assistance through ice-infested waters; controlled break-up of ice jams in restricted navigable waterways; and provision of ship time to other government departments and agencies.

Public Harbours and Ports are administered by Transport Canada at 476 locations across Canada.

The Canadian Hydrographic Service of the Department of Fisheries and Oceans plays a major role in marine transportation. The Canadian Hydrographic Service has a mandate to gather and publish hydrographic data and navigational information relating to Canada's navigable waters. Its activities include: hydrographic surveys; chart production, publication and distribution; production of tide, current and water-level data; production of sailing directions and small craft guides;

planning, training and setting of standards for surveys and cartography; nautical geodesy; development and transfer of technology; and provision of specialized services related to hydrography and cartography particularly in the fields of maritime boundaries and marine litigation.

Other Marine Services

The Canadian Coast Guard has responsibility for the eastern Arctic sea lift of supplies to military outposts, remote settlements and remote Environment Canada weather stations. It also provides route assistance through ice-infested waters and ensures controlled break-up of ice in restricted navigable waterways.

Public Works Canada provides architectural and engineering services to governments and private clients on marine works such as docks, wharves and breakwaters. It also provides dredging services.

DFO's Small Craft Harbours program manages the operation and maintenance of 2,255 small craft harbours (1,419 for commercial fishermen and 836 for recreational boaters). DFO also provides information on waves, currents and water temperatures for various marine engineering and aquaculture applications through the Marine Environmental Data Service.

The Energy, Mines and Resources offshore surveys program provides geodetic, topographic and geographic information which is important for offshore boundary establishment, as well as for the positioning of offshore activities such as drilling rigs.

Resource Development and Management

Federal programs related to resource development and management are intended to conserve, protect, develop and enhance the fisheries resource base; to assess the extent of non-renewable resources and facilitate their responsible exploration and exploitation; to prevent and control pollution; and to protect the habitat of marine organisms.

a) Living Resources

DFO has responsibility for the management, allocation and control of the marine fisheries in Canada. Activities undertaken to carry out that mandate include: resource assessment; licensing, allocation and regulation; enhancement and development; and monitoring control and surveillance. These operations are carried out in the Atlantic, Pacific and Arctic oceans.

DFO has also been given the lead role in developing an Arctic Marine Conservation Strategy, the purpose of which is to ensure the future health and well-being of Arctic marine ecosystems. This will enable Canada to fulfill its national and international responsibilities in the Arctic and to provide for the sustained utilization of Arctic marine resources, particularly by Arctic peoples.

Under the Migratory Birds Convention Act, Environment Canada has responsibility for the management and protection of those species of migratory sea-birds that are shared internationally.

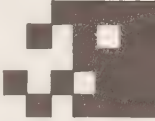
External Affairs is responsible for Canada's international relations and works with DFO in the management of international fisheries relations, including negotiations of bilateral and multilateral treaties.

b) Non-living Resources


Non-living resources include primarily oil and gas and offshore minerals. Responsibility for the mapping of the geology and resources of the seabed, and for the evaluation and assessment of its mineral and resource potential, resides with EMR's Geological Survey of Canada.

The regulation of oil and gas activities offshore and the calculation of quantities of discovered oil and gas in frontier lands are the responsibility of the Canada Oil and Gas Lands Administration (COGLA) which is jointly administered by EMR and the Department of Indian Affairs and Northern Development. COGLA's objective is to ensure vigorous and responsible development of petroleum resources on frontier lands within the prevailing policy and regulatory framework.

Offshore non-fuel minerals including sand and gravel, silica sands and gold-bearing sands are the responsibility of EMR south of 60° and the Department of Indian Affairs and Northern Development north of that line. Attempts are currently being made to improve the technical and geological information base and to promote a greater awareness of offshore mineral opportunities. Legislation to establish a framework for joint resource management with the coastal provinces is now in preparation.



c) Environmental Protection and Conservation



Environment Canada is responsible for environmental protection as it relates to pollution risks associated with offshore fuel and mineral resources exploitation; industrial discharges from land-based industries (Memorandum of Understanding between DFO and Environment Canada under which Environment Canada administers Section 33 of the Fisheries Act dealing with the control of pollutants affecting fish); ocean dumping; and ships' wastes. Environment Canada also plays an advisory role in such areas as environmental emergencies, shellfish protection, and the fate and effects of land-based pollutants. COGLA is accountable for assuring environmental protection with regard to oil and gas activities offshore and on land north of 60°. The Department of Indian Affairs and Northern Development is responsible for environmental protection of Arctic marine waters north of 60° as it relates to the disposal of non-ship derived waste. This is achieved through the administration of the Arctic Waters Pollution Prevention Act.

Environment Canada also establishes national marine parks under the National Parks Act to protect outstanding marine areas of national significance for the current and future generations of Canadians.

The Canadian Coast Guard exercises on-site command and control of marine emergencies, including clean-up of ship source pollution.

DFO has responsibility for the administration of those sections of the Fisheries Act dealing with the protection of fish habitat. This involves the review of development proposals made either directly or by referral for the conduct of activities which might have detrimental effects on fish habitat. Scientific research is aimed at conservation, restoration and development of fish habitats.

EMR's Geological Survey provides information on seabed and coastal processes which must be evaluated in any environmental assessment of offshore and coastal activities.

Represented by the responsible departments, Canada participates in the International Maritime Organization, the United Nations Environment Program, the International Union for the Conservation of Nature and Natural Resources, and the World Conservation Strategy which addresses global cooperation for resource management. Through these organizations, Canada is at the forefront of attempts to control and prevent marine pollution worldwide.

Sovereignty, Defence and Law of the Sea

Activities and programs in this category have the objective of affirming and enhancing Canadian sovereign rights as well as economic and political interests, and ensuring compliance with rules of international law and Canadian fishing and other resource regulations.

External Affairs has the primary role for coordinating issues relating to sovereignty. In maritime boundary negotiations, the role of External Affairs is to achieve acceptance of Canada's claims with respect to outstanding maritime boundary disputes. Canada is currently involved in disputes with the U.S., France and Denmark.

External Affairs coordinates measures to preserve and enhance sovereignty over the waters of the Arctic archipelago.

In consultation with other interested government agencies, External Affairs reviews foreign requests to conduct marine scientific research in offshore areas under Canadian jurisdiction.

A major task of External Affairs is to preserve and enhance Canadian sovereignty, sovereign rights and political and economic interests related to Law of the Sea issues. It is currently leading the Canadian delegation to the United Nations Convention on the Law of the Sea Preparatory Commission which is attempting to develop a satisfactory seabed mining regime. Financial, economic, technical and mineral policy advice is provided by the departments of Finance and Energy, Mines and Resources.

External Affairs also plays a major role in the interpretation and negotiation of bilateral and multilateral fishing agreements.

DFO makes a considerable contribution to the exercise of Canadian sovereign rights through its hydrographic and other scientific activities. A further tangible expression of sovereign rights is the monitoring, control and surveillance of offshore fisheries. The objective of the surveillance is to ensure that foreign and domestic offshore fleets comply with fisheries management measures aimed at ensuring the conservation and optimal use of offshore fish stocks.

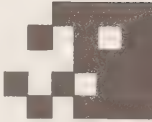
EMR contributes to sovereignty through its offshore survey program which provides geodetic information, and through the geological and geophysical surveys which establish a Canadian presence in the area and provide the resource evaluation and geoscience knowledge for the delineation of offshore boundaries.

The role of the Canadian Coast Guard (Transport Canada) in sovereignty, particularly in the Canadian Arctic, is evidenced in its application of the Arctic Waters Pollution Prevention Act. An enhanced sovereignty role will evolve with the construction of the Polar (Class 8) icebreaker.

Transport Canada is also the lead agency for the coordination of major Arctic transportation research and the promotion of a Canadian presence in commercial Arctic marine shipping through the Canarctic Shipping Co. Ltd.

Through its Maritime Command, DND provides an operationally ready maritime force to meet Canada's defence commitments. Besides its normal military mission, DND provides surveillance of Canadian territorial waters and the 200-mile zone on both coasts. As well, the Maritime Command provides support to other departments or agencies (e.g., aircraft and warship support for DFO's fisheries surveillance and enforcement program). As discussed earlier, DND's maritime activities draw significantly on oceans-sector goods and services.

Environment Canada contributes to sovereignty through the provision of marine weather warning and forecast services for Canadian territorial waters out to the 200-mile limit. The development of national marine parks in the Arctic is another way in which Environment Canada will reinforce Canadian sovereignty.



Northern Development

The purpose of federal programs in northern development is to promote the development of northern resources while ensuring the integrity of the northern environment and the opportunity for Native people to pursue a traditional lifestyle. The lead role in the North is played by the Department of Indian Affairs and Northern Development. Its activities include:

- oil and gas regulations north of 60° (through COGLA);
- Indian and Inuit environmental protection;
- identification of granular resources (sand and gravel) in the Beaufort Sea region;
- allocation of granular resources and authorization of the construction of man-made islands for petroleum development;
- northern oil and gas resource management studies;
- pollution prevention in Arctic waters through the management of non-shipping activities; and
- northern land-use planning.

DFO activities in Arctic waters include fisheries and habitat management, hydrography and oceanography.

Besides its ice-breaking support and aids to navigation, the Canadian Coast Guard regulates the access of vessels to Arctic waters for purposes of safety and pollution prevention.

In cooperation with the Canadian Coast Guard, Environment Canada provides ice-forecast services to support planning for and operation of marine transportation in the North.

EMR is responsible for the Polar Continental Shelf Project through which EMR maintains a comprehensive field support network of transportation and communication, and provides professional, technical and managerial advice for research projects in the North. Geoscience studies in the Arctic are carried out by the Geological Survey of Canada, principally through its Frontier Geoscience Energy Program.

Industrial Development

The federal government has an important role in promoting the development of oceans-related industries. Within the mandate of the Department of Regional Industrial Expansion (DRIE) relating to industrial development in the manufacturing and processing sector, there are programs and activities which have a direct impact on oceanic industries. These include:

- the Industrial and Regional Development Program (IRDP) for the provision of financial support for private-sector initiatives primarily in the manufacturing sectors and in disadvantaged regions of Canada; and
- the Defence Industry Productivity Program (DIPP) which provides contributions and loans for research and development, source establishment and modernization projects aimed at maintaining a defence technological capability, and promotion of defence-related exports.

DRIE also administers, on behalf of the federal government, a number of ERDA sub-agreements. These include:

- Canada/Nova Scotia Ocean Industry Sub-Agreement. The five-year agreement, recently extended for a year to July 1987, provides capital and marketing assistance and applied research support to medium- to high-technology ocean manufacturing and service industries in Nova Scotia. Total DRIE funding available under the agreement is \$23 million, including \$4 million to operate an Ocean Industry Development Centre in Halifax.

- Canada/Newfoundland Ocean Industry Development Sub-Agreement. The objective of the five-year agreement, which terminates in March 1989, is full exploitation by local businesses and communities of the industrial R&D and supply opportunities arising from the offshore mineral developments, the fishery and marine transportation. Assistance is available to Newfoundland-based firms engaged in applied R&D, technology application and transfer, and the provision of specialized industrial expertise or services. Total DRIE funding available is \$19 million, including \$4 million for a federal office in St. John's to administer the agreement.

The recently created Atlantic Canada Opportunities Agency will subsume the management of some of these activities within the Atlantic Region.

Pursuant to the offshore oil and gas resource management and revenue sharing accords with the provinces of Newfoundland and Nova Scotia, Offshore Development Funds were established. These funds are intended to help the

provinces put in place the infrastructure needed for oil and gas development. The federal contribution through the Newfoundland fund is \$225 million; Nova Scotia, \$200 million.

The National Research Council, through the Industrial Research Assistance Program, facilitates the transfer of technology from government laboratories and universities to industry for commercial exploitation. Contribution arrangements involve cost-sharing between the NRC and the company.

Supply and Services Canada administers the Atlantic Opportunities Program, the objective of which is to foster the development of long-term economic growth in Atlantic Canada by substantially increasing public-sector procurement in that region. The objective is to increase federal government procurement expenditures from \$1.6 billion to \$2.2 billion over the next four years.

Public Works Canada maintains and operates dry docks at Lauzon, Quebec and Esquimalt, B.C. in support of the ship-repair industry. Attempts are being made to sell the facilities or at least to derive full cost-recovery.

Through DFO, agreements with the provinces are being negotiated to remove the regulatory impediments to the development of a viable commercial aquaculture industry in Canada.

External Affairs is active in defending and expanding markets abroad for Canadian fish and marine mammals. This involves the development and implementation of market plans, the provision of market assistance, promotional programs, interpretation of trade regulations, etc. The Technology Inflow Program of External Affairs provides financial support (travel costs and accommodation) to Canadian companies wishing to access foreign technology.

The Canada Oil and Gas Lands Administration is responsible for the implementation of "Canada Benefits" provisions in the context of work programs within offshore exploration agreements.

Marine Science and Technology Development

Federal programs in marine science and technology development are designed to provide scientific information and advice for the management of ocean resources; to support scientific research into ocean processes; and to promote technological innovation in oceans-related industries.

As discussed earlier, an Interdepartmental Committee on Oceans is coordinating federal activities respecting marine science.

DFO has important responsibilities in marine science. Knowledge and understanding gained through marine science activities are an important element in management activities, regulation setting, design and construction, safety, environmental protection and conservation, etc., relating to oceans. Specific science programs within DFO include physical and chemical oceanography, marine ecology, habitat research and fisheries science. Extensive aquaculture and resource development research is conducted in support of the development of aquaculture as a viable and productive Canadian industry, especially salmonid enhancement and shellfish farming.

EMR's programs include: research on materials (steel and concrete) for offshore structures; offshore geoscience; and remote sensing of natural resources and the environment.

As mentioned previously, the Minister of State for Science and Technology is responsible for developing a national policy on science and technology, and a Canadian Strategy for Science and Technology, InnovAction, has been developed.

On behalf of the departments of Indian Affairs and Northern Development and Energy, Mines and Resources, the Canada Oil and Gas Lands Administration administers the Environmental Studies Revolving Fund, which finances research studies required for regulating offshore activities through levies on oil and gas companies.

Environment Canada conducts R&D on pollution control, oil-spill cleanup and waste treatment technologies and is involved in the development of models for wind and wave forecasting, storm surge, oil-slick trajectories and sea-ice and iceberg forecasting. It also operates the Canadian Climate Centre where research is undertaken on climate prediction techniques, global atmospheric circulation modelling and the effects of CO₂, and other greenhouse gases on the ocean and the atmosphere. DFO also supports university research in marine meteorology and climate. R&D is also conducted in relation to migratory birds as well as surveillance, monitoring and analytical methods related to environmental quality.

The Canadian Coast Guard conducts both mission-oriented and operational R&D to enable marine operations in the Canadian Arctic on an extended-season basis. Close liaison is maintained with other operational departments through an Interdepartmental Committee on Arctic Marine R&D. Liaison with industry and provincial research centres is also supported.

The marine focus of the National Research Council is on biology, chemistry and engineering. Emphasis is put on client service and technology transfer to the private sector. This is accomplished through the provision of national facilities such as the Institute of Marine Dynamics in St. John's, Newfoundland and through financial assistance programs such as the Industrial Research Assistance Program.

The Unsolicited Proposals Program administered by SSC provides funding (\$15 million annually of which \$6 million relates to ocean activities) to encourage private-sector R&D which is relevant to the science missions of government departments or agencies. The program is an instrument of the federal policy of contracting out science and technology activities.

The Natural Sciences and Engineering Research Council administers a program of scholarships and grants, the purpose of which is to promote and support the development and maintenance of research in the natural sciences and engineering and to ensure the provision of highly-qualified manpower in these areas.

The Interdepartmental Panel on Energy Research and Development, chaired and administered by EMR, coordinates the activities involved in the Federal Energy R&D Program. The Panel's resources augment existing budgets of the participating departments in order to accelerate and coordinate their response to federal energy policy objectives. These activities are conducted in many departments and provide major support for federal oceans-related programs.

Canada (primarily through EMR) participates in the Ocean Drilling Program, a U.S.-led international geoscience and technology development drilling program. The goal of the program is to improve the global understanding of the rocks and sediments beneath the oceans. Other federal departments involved include DFO, the Department of Regional Industrial Expansion and the Ministry of State for Science and Technology, with funding assistance from the National Research Council and the Natural Sciences and Engineering Research Council.

The Department of National Defence's research and development program is aimed at improving the operational capabilities of the Canadian Forces by the productive application of advances in science and technology. The department operates six research establishments across the country.

The Canada/Newfoundland Institute of Fisheries and Marine Technology Subsidiary Agreement was signed in May 1983 to establish an institute to meet the skilled training needs of offshore industries in Newfoundland and Atlantic Canada, and in particular the fisheries, and the offshore petroleum and merchant shipping industries.

**Government/Industry
Interaction**

In September 1986, DFO sponsored Oceans Forum, a national conference at the Institute of Ocean Sciences, Patricia Bay, British Columbia. The theme of the conference was "Issues and Opportunities on the Oceans Frontier". The spectrum of interests represented at Oceans Forum included the petroleum exploration and development industry, fishing, aquaculture, advanced technology manufacturing, a wide range of science-based oceanic services, shipping, ship-building, ocean law, oceanography and related sciences, and federal government departments with policies and programs involving oceans. The purpose of the forum was to provide representatives of the oceans sector and government an opportunity to exchange views and to begin charting a long-term plan for Canada's oceans economy.

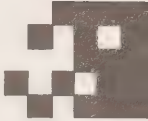
Although a diversity of views was put forward, a consensus was reached regarding the need to establish a solid foundation for an oceans policy. In particular, three tasks are required, namely:


1. to review and restate Canadian oceans policy, with a primary focus on the maximization of economic, scientific and sovereignty benefits to Canada;
2. to establish a framework of legislation which facilitates oceans development, particularly as it relates to the Exclusive Economic Zone as defined within the United Nations Convention on the Law of the Sea; and
3. to develop a consultative mechanism for industry, the universities and other interests to express their views to Government on oceans issues.

Cooperation is required to ensure that federal oceans and fisheries research activities are accurately focused towards the needs of the oceans sector. Ocean services should be similarly focused. Furthermore, there is a need to enhance technology development and transfer. The establishment of the national oceans council, as suggested at Oceans Forum, should be instrumental in improving needed interfaces among different groups involved in the oceans economy.

The development and commercialization of new technologies in the oceans sector carries high risks. If Canada is to compete in world markets for these technologies, a key question to resolve for each oceanic industry is whether market forces alone are sufficient to allocate economic activity towards opportunities for Canada. In emerging growth industries such as high technology industries, where innovative companies are small and relatively new, there is a need to assess whether federal framework policies are appropriate to assist the private sector. Not enough is known about the economic value of government oceans activities in terms of their impact on industry performance, employment, and income. Nor do we have an adequate measure of the efficiency or effectiveness of the technology-transfer process.

Measures of success of ocean science and technology development are difficult to establish. For example, DFO has numerous clients for its oceans science outputs which use these outputs in different ways. Ocean science, technology and survey products, for example, are used





by the Department of National Defence, the fishing industry, Environment Canada, the scientific community and by coastal zone managers for such diverse purposes as marine transportation, resource extraction, recreation and energy. Often such information is transmitted via other government departments whose information processes make it difficult for the originating department to isolate the value of the information.

Several federal departments have programs which support technology development and transfer such as the Unsolicited Proposals Program through the Department of Supply and Services; the Program for Industry/Laboratory Projects and the Industrial Research Assistance Program through the National Research Council; the Bio-energy Development Program, the Canada Center for Mineral and Energy Technology Energy Conversion Cost-Shared Program, ENERDEMO, and the Industry Energy Research and Development Program through EMR; and the Industrial and Regional Development Program through the Department of Regional Industrial Expansion. There is a need to review the effect of these programs on the oceanic industries and to establish whether improvements are necessary. Such a review would need to determine the correlation between government expenditures on the oceanic industries and market opportunities, and propose modifications to ensure that government involvement promotes those oceanic industries with the most potential in a manner consistent with overall government priorities.

There is a need to review the experiences of other nations so that policies directed toward Canadian ocean industries will avoid the mistakes and benefit from the successes of others. Some countries (e.g., Norway) are reported to be using heritage funds to accelerate their development of new oceans technology, while in many other countries research and development expenditures are far greater than they are in Canada. Canada will need to be more involved in international collaboration and in the analysis of foreign strategic ocean industries development policies if it is to move rapidly in its technological applications and development.

Not all ocean industries have the same demand for oceans science information and innovative technology. In the oil and gas and shipping industries, the general trend in Canada is towards the adaptation of U.S. and European technology rather than the development of new technology. One recent study lists eight categories of new technologies required for the development of the east-coast oil and gas industry. The Ministry of State for Science and Technology estimates that \$620 million could be spent on high technology for Beaufort, Venture, and Hibernia. Assuming 25 per cent of the high-technology component was labour, this would generate about 3,100 person-years of employment. Other off-shore petroleum-related projects such as production from other fields, continued exploration and delineation drilling, construction of drilling rigs, production platforms, icebreakers, and support vessels, and production and transportation of hydrocarbons from the Arctic Islands, would boost this figure further.

Although Canada effectively applies technologies from other countries, there are significant areas where Canada is a world leader, including underwater technology products: the DOLPHIN (Deep Ocean Logging Platform with Hydrographic Instrumentation and Navigation), for example, is a remotely controlled semi-submersible capable of replacing the manned survey launch for conventional hydrographic surveys; the Larson 500 permits hydrographic surveying from an aircraft in water depths up to 35 metres; the ARCS (Autonomous Remote Controlled Submersible) is particularly designed to conduct surveys under ice; and the Electronic Chart is a digital version of the nautical chart which provides integrated navigation information including the positions of other ships, icebergs and landmarks.

Federal government research activities generally bring technologies to the point where they have useful ocean research applications and leave their commercialization totally to the private sector. Should this continue to be a guiding principle in the oceans sector? Should some areas be targeted for increased government program funding? Are the skills and experience being effectively transferred along with the technology out of government? What are the factors necessary for successful technology transfer and commercialization? These are the types of questions which challenge the successful future development of Canada's oceans sector and which must be addressed in the future as Canada moves to implement a broad framework for the development of the oceans economy which will provide maximum economic, scientific and sovereignty benefits to Canadians.

References

- Canada Oil and Gas Lands Administration Annual Report 1985. Supply and Services Canada.
- Canadian Shipbuilding and Ship Repairing Association. 1986. Canadian Shipbuilding and Ship Repairing Association 1985 Annual Statistical Report.
- Canadian Transport Commission. 1985. Transport Review – Trends and Selected Issues, 1985. Supply and Services Canada.
- Department of External Affairs. 1978. Canada and the Law of the Sea: Resource Information. Bureau of Public Affairs, External Affairs Canada.
- Department of Finance. 1986. 1986-87 Estimates, Part III, National Defence. Canadian Government Publishing Centre, Supply and Services Canada.
- Department of Fisheries and Oceans. 1980. Fisheries Sector Research and Development. Internal paper prepared by Resource Services Directorate, Department of Fisheries and Oceans.
- Department of Regional Industrial Expansion. 1985. The Canadian Shipbuilding and Repair Industry: Sector Profile. Automotive, Marine and Rail Branch, Regional Industrial Expansion.
- Hale, P.B., 1984. Re-appraisal of Offshore Mining Non-fuel Mineral Development Potential. Canada Oil and Gas Lands Administration, Ocean Mining Division Document No. 1984-2.
- Hale, P.B. and P. McLaren, 1984. A Preliminary Assessment of Unconsolidated Mineral Resources in the Canadian Offshore, *Canadian Mining and Metallurgical Bulletin*, September, p. 51-61.
- Hall, J. and T.D.W. McCulloch. 1986. Canada's Oceanic Manufacturing and Services Industries: 1986 Status Report. A report prepared for the Oceans Task Force, Department of Fisheries and Oceans.
- Pasho, D.W. 1983. Opportunities for Non-fuel Offshore Mineral Resource Development. Canada Oil and Gas Lands Administration, Ocean Mining Division Document No. 1983-3.
- Winokur, R.S. and R.E. Gonzalez, Jr. 1982. Ocean Science and Military Use of the Ocean. *Oceans*, Vol. 25, No. 4 (winter): 58-66.

■ ■ ■ ■ ■ ■ ■ ■ ■ ■

Appendix: Inventory of Federal Oceans-Related Programs and Activities

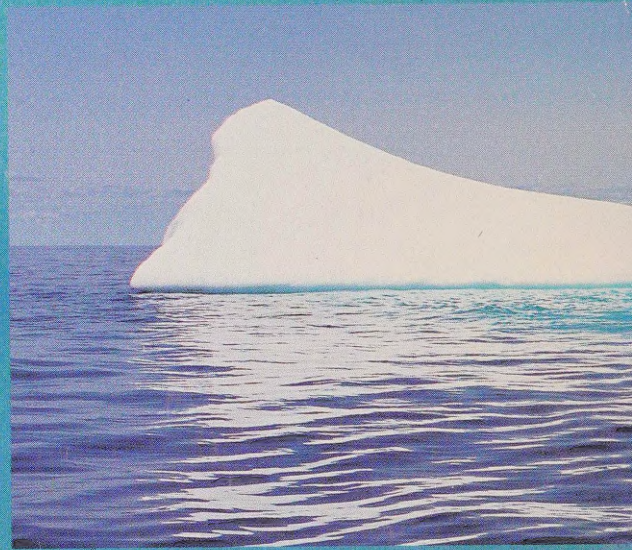
Program	Responsible Dept. or Agency	Governing Legislation	Program Resources ^a \$M	PYs
1. Marine Transportation				
● Marine Navigation Systems	CCG	Canada Shipping Act	210	3 300
● Marine Regulatory : Ship Safety	CCG	Canada Shipping Act	23	395
● Icebreaking and Other Arctic Operations	CCG	Arctic Waters Pollution Prevention Act National Transportation Act	90	1 025
● Harbour Management	CCG	Public Harbours and Port Facilities Act	37	90
● Hydrography	DFO	Government Organization Act 1979 Territorial Seas and Fishing Zones Act Charts and Publications Regulations	40	585
2. Marine Services				
■ Search and Rescue	CCG, DND, DFO	Safety of Life at Sea Convention, Canada Shipping Act	120	1 820
● Ice Management/Flood Control	CCG	Department of Transport Act	6	65
● Eastern Arctic Sealift	CCG	Treasury Board Approval (June 1981)	7	11
● Marine Architecture & Engineering	PW	Public Works Act	165	410
● Dredging and Fleet Services	PW	Public Works Act	25	240
● Small Craft Harbours	DFO	Government Organization Act Fishing & Recreational Harbours Act	43	95
● Ice Services	DOE	Government Organization Act (1970 and 1979)		
● Marine Weather	DOE	Government Organization Act (1970)	2	29
● Marine Climate	DOE	Government Organization Act (1970 and 1979)	1	5
● Offshore Surveys	EMR	Canada Lands Surveys Act (1970) Government Organization Acts (1970 and 1979) Resource and Technical Surveys Act (1966-67)	0.3	6
● Marine Transport Export Services	EA	External Affairs Act (1983)	0.1	2
3. Resource Development and Management (incl. environmental protection)				
● Fisheries Resource Allocation, Licensing and Regulations	DFO	Fisheries Act	13	200
● Monitoring, Control & Surveillance Inshore and Nearshore	DFO	Fisheries Act Coastal Fisheries Protection Act	44	925
● Fisheries Enhancement and Development	DFO	Fisheries Development Act	68	420
● Habitat Management	DFO	Fisheries Act	6	75
● Arctic Marine Conservation	DFO	Fisheries Act		
● Petroleum Development – COGLA	EMR/DIAND	Canada Oil and Gas Act Oil and Gas Production and Conservation Act Canada Petroleum Resource Act	17	225
● Control of Pollution from Land Based Sources	DOE	Government Organization Act (1979) Fisheries Act, Section 33	2	35
● Environmental Protection re. Offshore Petroleum and Mineral Resources	DOE	Government Organization Act (1979) Fisheries Act, Section 33 Oceans Dumping Control Act	1	9
● Ocean Dumping Control	DOE	Ocean Dumping Control Act Fisheries Act, Section 33	1	12
● Control of Ship-Source Discharges	CCG	Government Organization Act (1979) Fisheries Act, Section 33	0.2	3
● National Marine Parks	DOE	National Parks Act	0.3	3

Program	Responsible Dept. or Agency	Governing Legislation	Program Resources \$M	PYs
3. Resource Development and Management (incl. environmental protection) (cont.)				
● Marine Environment Protection World-wide	EA	External Affairs Act (1982)	0.3	2
● Emergencies/Clean-up of Ship Source Pollution	CCG	Canada Shipping Act Emergency Planning Orders National Marine Emergency Plan	5	60
Framework for Development of Offshore Non-Fuel Minerals	EMR	Energy, Mines and Resources Act	0.3	3
Offshore Geoscience Information	EMR	Resource and Technology Surveys Act Energy, Mines and Resources Act	14	75
4. Sovereignty, Defence and Law of the Sea				
● Maritime Boundary Negotiations	EA	External Affairs Act (1983)	0.2	5
● US-Canada Arctic Cooperation and Coordination	EA	External Affairs Act (1983)	0.2	3
● Law of the Sea	EA	External Affairs Act (1983)	0.1	1
● International Fisheries Agreements (resources shown for EA only)	EA/DFO	Fisheries Act	0.2	6
● Monitoring, Control & Surveillance, Offshore	DFO/CCG/DND	Coastal Fisheries Protection Act Fisheries Act Territorial Sea & Fishing Zones Act	36	310
● Maritime Command	DND	National Defence Act	1 660	17 800
5. Northern Development				
● Northern Land Use Planning	DIAND	Indian Affairs & Northern Development Act	2	22
● Indian and Inuit Environmental Protection	DIAND	Indian Act	0.5	1
● Studies for Northern Oil & Gas Resource Management	DIAND (NOGAP)	Indian and Northern Affairs Act	1	5
● Granular Resources and Man-made Islands in Beaufort	DIAND	Public Lands Grants Act	0.4	1
● Pollution Prevention in Arctic Waters	DIAND	Arctic Waters Pollution Prevention Act	0.2	4
● Polar Continental Shelf Project	EMR	Cabinet Decision	2	5
● Petroleum Development and Related Environmental Projection-COGLA (resources reported under "C")	DIAND	Oil and Gas Conservation and Protection Act Canada Oil and Gas Act		
● Arctic Icebreaking (resources reported under "A")	CCG	Canada Shipping Act Arctic Waters Pollution Prevention Act		
6. Industrial Development				
● Industrial and Regional Development Program	DRIE	Industrial and Regional Development Act	8	—
● Canada/Nova Scotia Ocean Industry Subsidiary Agreement	DRIE	Industrial and Regional	4	—
● Canada/Newfoundland Ocean Industry Subsidiary Agreement	DRIE	Industrial and Regional Development Act	3	—
● Atlantic Opportunities Program	DSS	Cabinet Decision (April 22, 1986)	N/A	—
● Defence Industry Productivity Program	DRIE	Treasury Board Directives	6	—
● Operation and Maintenance of Certain Dry Docks	PW	Public Works Act	N/A	N/A
● International Fish Trade Development	EA	External Affairs Act (1983)	0.4	8
● Program for Export Market Development	EA/DRIE		5	—

Program	Responsible Dept. or Agency	Governing Legislation	Program Resources \$M	PYs
7. Marine Science and Technology Development				
● Fisheries Resource Assessment Research	DFO	Fisheries Act	75	930
● Aquaculture Research	DFO	Fisheries Development Act	7	105
● Habitat Assessment and Research	DFO	Fisheries Act	8	110
● Resource Development Research	DFO	Fisheries Development Act	20	195
● Physical Oceanography	DFO	Government Organization 1979	27	361
● Chemical Oceanography	DFO	Government Organization 1979	7	107
● Marine Ecology	DFO	Government Organization 1979	14	179
● Offshore Geoscience Activities	EMR	Resource & Technical Surveys Act	9	110
● Materials for Offshore Structures	EMR	Energy, Mines and Resources Act Energy, Mines and Resources Mandate/ PERD	2	9
● Remote Sensing Relating to Oceans	EMR	Treasury Board Minute Energy, Mines and Resources Act	0.2	1
● Ocean Drilling Program	EMR et al	Cabinet Decision	4	3
● Unsolicited Proposals Program	DSS	Appropriation Act	6	—
● Marine Engineering (incl. \$ 1,500M IRAP/PILP)	NRC	NRC Act (1966-67)	10	65
● Marine Biology and Chemistry (incl. \$ 1,500M IRAP/PILP)	NRC	NRC Act (1966-67)	5	33
● Grant Support to Universities	NSERC	NSERC Act	8	—
● Climate Research	DOE	Government Organization Act 1979	1	5
● Canada/Nfld. Institute of Fisheries and Marine Technology Subsidiary Agreements	DRIE	Industrial and Regional Development Act		
● Defence R&D	DND	National Defence Act	45	245
● Arctic R&D	CCG	Arctic Waters Pollution Prevention Act	2	3
Total Oceans-Related Activities				
<i>Excluding Maritime Command</i>			1 300	13 000
<i>Including Maritime Command</i>			3 000	31 000

Note: Most of the financial resource data relates to fiscal year 1986/87.

^aorder-of-magnitude estimates only



Canada